SOCIETIES AND ACADEMIES

LONDON

Physical Society, April 25.—Prof. Guthrie, President, in the chair.—The following papers were read:—On the theory of illumination in a fog, by Lord Rayleigh. The paper dealt with certain theoretical results based upon the assumption that the medium in which the fog was formed and the substance composing the fog itself were perfectly transparent. The effect of such a fog surrounding a source of radiation would be to diminish the radiation, and in the case of a supply of energy from without, as with the carbon filament of an incandescent lamp, the temperature of the source would be increased by the fog. A spherical envelope of such a fog surrounding the lamp, and sufficiently thick to be impervious, would act as a perfectly reflecting surface. A problem closely related to the above, and which is easily worked out, is that of light incident normally upon a pile of glass plates. If m be the number of such plates, and ρ the fraction of incident light reflected by one plate, $\phi(m)$ the light reflected, and $\psi(m)$ that transmitted by a pile of m plates, we have—

$$\frac{\phi(m)}{2m\rho} = \frac{1}{1+(2m-1)\rho} = \frac{\psi(m)}{1-\rho}.$$

If the transmitted light be allowed to fall upon another pile consisting of n plates, we have an infinite amount of reflection between the plates, and as the final result if A denotes the radiation in the original direction, and B that in the opposite,

$$A = \frac{2n\rho + 1 - \rho}{2(m+n)\rho} \qquad B = \frac{2n\rho}{2(m+n)\rho + 1}.$$

If m and n are large, we have—

$$A = B = \frac{n}{m+n},$$

which shows that by increasing n we can make the radiation between the plates as much as if the first pile did not exist whatever the number of plates in it.—On a monochromatic telescope, by Lord Rayleigh. This is a modification of Maxwell's colour-box. In this instrument, as is well known, light passes through a slit in the focus of a collimating lens; it traverses in succession this lens, a prism, and another lens by which it is brought to a focus upon a plane surface in which is a movable slit, the eye being placed behind which receives light approximately monochromatic. If, in addition, a lens be placed just behind the first slit, so as to bring some distant object into focus at a convenient distance from the eye, this object will be seen by the light that would enter the eye in the simple colour-box. The author suggested the use of this instrument to compare lights of different colours, and hinted at the possibility of choosing some colour towards the middle of the spectrum at which light might be compared for practical purposes.—On the self-regulation of the compound dynamo, by Prof. A. W. Rücker. If ϕ represents the current or electromotive force in the external circuit of either form of compound dynamo, it is given by means of an equation of the form

$$\phi = \frac{P}{A+x} - \frac{Q}{B+x},$$

where A, B, P, and Q are quantities which are different in different cases, but are always independent of the external resistance, and x is the conductivity or the resistance of the external circuit, according as ϕ represents the E.M.F., or current. The constant A in all cases depends only on the resistance of the various parts of the machine. If μ and m are respectively the largest and smallest values of x between which self-regulation is aimed at, then $\mu - m$ may be called the *range of* x. That value of x which corresponds to the resistance most frequently used may be called the *usual value* of x and indicated by ξ. The maximum efficiency η of the machine is connected with A and ξ by the relations

$A = \xi(1+\eta)/(1-\eta)$ if ϕ be the external E.M.F.
$A = \xi(1+\eta)/(1+\eta)$ if ϕ be the external current.

It can easily be shown that the function ϕ has two critical values, and that the value of x, corresponding to one of these, is necessarily negative, unless one of the inducing spirals is wound so as to diminish the magnetisation Various cases are considered, corresponding to different relations among the magnitudes of the constants A, B, P, and Q. The following indications of the method of treatment may suffice. If $A/B < 1 < \sqrt{P}/\sqrt{Q}$, ϕ is positive for all positive values of x, and the critical value of ϕ occurs for a negative value of x, so that ϕ diminishes as x increases. Hence, if we write

$$\frac{P}{A+m} - \frac{Q}{B+m} = \Phi,$$

we must have

$$\frac{P}{A+\mu} - \frac{Q}{B+\mu} = \frac{\phi_1}{1+q},$$

where q is a positive quantity which will be less as the self-regulation is more perfect. These equations give

$$P = \frac{\phi_1}{1+q} \cdot \frac{\mu - m - q(B+m)}{(A-B)(\mu-m)} (A+\mu)(A+m)$$

$$Q = \frac{\phi_1}{1+q} \frac{\mu - m - q(A+m)}{(A-B)\mu - m)} (B+\mu)B+m).$$

Now since $A - B$ is negative, we must, if P and Q are positive, have

$$q < (\mu - m)/(A+m),$$

and *a fortiori*.

$$q < (\mu - m)/(B+m).$$

By similar methods inferior limits to q are found in other cases, and it is thus shown that for given values of μ and m, the limit is lower as A is larger. It has, however, been proved above that if the maximum efficiency of the machine is high, A will be large or small, according as it is taken from an expression that gives the external E.M.F. or the external current. Hence it is more difficult to combine high efficiency with good self-regulation if an approximately constant external current is desired than if an approximately constant external E.M.F. is aimed at. The equations do not lead to any simple rules for the relations which should hold between the various parts of compound dynamos; but if some of the constants are taken as given, the values which must be assigned to the others can be calculated if a given efficiency for the usual value of x and a given deviation from perfect self-regulation between given values of x are to be attained.—On the determination of the heat-capacity of a thermometer, by Mr. J. W. Clark. The method consists in the estimation of the masses of the mercury and glass of the thermometer by weighing the instrument in air and in water, and again in water when immersed to the extent usual in the thermal experiment. The specific gravity of the glass and mercury being known, the absolute masses immersed can be readily calculated, and consequently their thermal capacity.—A photometer which enabled a comparison to be made between the light of a lamp emitted at any angle and a standard was exhibited by Mr. Dibdin, and the action explained by Mr. Livingstone, who stated that the maximum amount of illumination took place at an angle of 45°.

Geological Society, April 15.—Prof. T. G. Bonney, F.R.S., President, in the chair.—John Rudd Leeson, M.D., was elected a Fellow of the Society.—The following communications were read:—A general section of the Bagshot strata from Aldershot to Wokingham, by the Rev. A. Irving, F.G.S. The author referred to earlier papers in the *Geological Magazine*, in which the green colouring-matter so common in the Middle and Lower Bagshot strata of the London Basin had been attributed to the presence of vegetable *débris* and the materials resulting from decomposition of vegetable matter. The marked difference in this respect between these strata and the higher members of the series furnishes a clue to the conditions under which they were respectively deposited, the former being delta- and lagoon-deposits, the latter the deposits of a marine estuary. This implies a transgressive overlap of the upper portions of the Bagshot series upon the London clay; and the present paper was devoted to a consideration of the stratigraphical evidence of this overlap. Sections were described in detail at Aldershot, Farnborough, Yateley, Camberley, Wellington College and the neighbourhood, and from the last-named place to Wokingham. From these a general section was constructed to exact scale, both as to thickness of strata and altitudes, showing a relation of the Bagshot formation to the London clay which was inconsistent with the generally received idea of their conformability and at variance with the mapping of the district as executed by the Geological Survey. The importance of the Bagshot pebble-bed as a basement-line of the upper division of the Bagshot strata was shown, as was suggested by the author so long ago as 1880. The synclinal arrangement of the London clay was shown to have been produced *before* the deposition of the Bagshot series, though a

certain amount of movement (with a resultant amount of 150 feet of tilting in thirteen miles from south to north) has since taken place.—Notes on the Polyzoa and Foraminifera of the Cambridge greensand, by G. R. Vine. Communicated by Thomas Jesson, F.G.S.

Royal Meteorological Society, April 15.—Mr. R. H. Scott, F.R.S., President, in the chair.—The following papers were read:—Report of Committee on Decrease of Water-Supply. This Committee was appointed to take into consideration the question of the decrease of water in springs, streams, and rivers, and also the simultaneous rise of the flood-level in cultivated countries. As far as any inference can be drawn from the records collected by the Committee, it appears that the years 1820, 1821, 1824, 1835, 1838, 1845, 1847, 1850, 1854, 1855, 1858, 1859, 1864, 1865, 1871, 1874, 1875, and 1884 have been periods of marked low water. On the other hand, the years 1817, 1825, 1830, 1836, 1841, 1842, 1853, 1860, 1861, 1866, 1873, 1877, 1879, 1881, and 1883 have been periods when there has been exceptionally high water. In 1852 the water was very low in the early part of the year, while at the end of the year it was very high. In the intervening periods the water has been of moderate altitude. It does not appear from existing records that there is any diminution in the water-supply of this country, and the large quantity of water which has been stored or has flowed off the ground between 1876 and 1884 is confirmatory of this view. There appear, however, to be periods when there is exceptionally low water, and these are almost immediately followed by periods of exceptionally high water. With reference to the increase of floods, it does not appear from the records that there is any great increase in the height to which the floods rise in this country. Whether or not the height to which floods have risen in recent years has been affected by river improvements and the greater facility with which floods can be got rid of, or whether there is a diminution in the quantity of water, are questions upon which the Committee have not at present sufficient information to speak positively.—Report of Committee on the occurrences of the Helm-Wind of Cross Fell, Cumberland, from 1871 to 1884. In response to a letter inserted in the Penrith newspapers, the Committee has received a number of communications bearing on the subject of the helm-wind. With the view of ascertaining as far as possible the meteorological conditions which exist when the helm-wind is blowing, all the recorded occurrences that have been received have been chronologically arranged. The first systematic record commences in 1871, and in this report the Committee deals with all occurrences from that date to the end of 1884. Since that time more detailed records have been commenced at numerous stations in the locality at the instigation of the Royal Meteorological Society. Ninety-three instances of the helm-wind were recorded from 1871 to 1884; the months with the greatest frequency being February, March, April, and November. On examining the Daily Weather Reports it was clearly seen that, whenever the helm-wind was blowing there was an easterly wind, not only in the locality, but generally over the entire country. As the helm-wind seemed to occur so regularly with the easterly wind, the Committee further extended the inquiry with regard to the east wind. The Daily Weather Charts were consequently examined for each day from January 1, 1871, to December 31, 1884, and every occurrence of east wind tabulated; the instances with general easterly conditions over the whole country being kept separate from those instances in which the easterly wind was only partial, though of sufficient intensity to occasion the helm-wind. This examination showed that, although the wind over the United Kingdom is generally easterly when the helm occurs, yet the helm by no means occurs whenever the wind is easterly. Indeed, this step in the inquiry has not at all tended to the elucidation of the phenomenon in question, for it frequently happens that the conditions are, to all appearances, precisely similar when the helm is on, and yet no such occurrence has been recorded. This may in part be due to the occasional omission to record the helm, although it cannot possibly be, in the main, attributable to such an omission; but it points to other conditions being necessary besides absolute agreement of wind direction and isobaric lines. Possibly the different hygrometric qualities of the air with the existing easterly winds may be an important factor in deciding whether or no the helm will be formed, but it is not readily conceived why, even in this case, the helm wind should not blow. It must, however, be borne in mind that the surface-winds can only be examined, whilst those at a comparatively small elevation may be intimetely connected with the phenomenon. From the observations made prior to those started at the beginning of 1885, no idea can be formed of the behaviour of the upper currents, even at the time of the occurrence of the helm-winds, far less with the occurrence of each east wind experienced. The Society has, however, provided for the extension of the inquiry in this direction in the records which are now being collected, the observers supplying observations of the upper currents by means of the clouds, as well as the direction of the winds at the surface of the earth. As soon as a sufficient number of these observations have been received, the Committee hopes to present a further report, which will tend to explain the phenomenon of the helm-wind.—Results of meteorological observations made at Asuncion, Paraguay, by R. Strachan, F.R.Met.Soc.

PARIS

Academy of Sciences, April 27.—M. Bouley, President, in the chair.—Experimental researches regarding (1) Attacks of an epileptic character excited by the electrisation of the excito-motor regions of the brain properly so-called; (2) the duration after death of the excitability so produced in the brain, by M. Vulpian. The main object of these experiments, made chiefly on dogs, is to confirm the conclusion already arrived at and communicated by the author in a previous paper, that the grey cortical substance of the cerebral regions known as motor centres does not play the indispensable part hitherto supposed in the production of epileptic attacks caused by the faradisation of those regions. The inference is also confirmed that amongst the higher mammals under normal conditions the cerebral substance proper loses its excitability as soon as the circulation has completely ceased in the nerve-centres.—Nebula discovered, observed, and tabulated at the Observatory of Marseilles, by M. E. Stephan.—Results of the boring recently carried out at Ricard, in the Grand'-Combe Valley, Gard, in search for coal, by M. Grand'-Eury. These borings tend to confirm the conclusion, already arrived at on other grounds, that no parallelism exists between the St. Barbe and Grand'-Combe geological systems, and as the former are unquestionably the older, they must, in the normal state, necessarily underlie the latter.—Report on the relation between the phenomena presented by the recent earthquakes in Andalusia, and the geological constitution of the region comprised within the area of disturbance, by M. Fouqué.—Remarks on an instrument analogous to the sextant, by means of which angles projected on the horizon may be directly measured, by M. E. H. Amagat.—Note on the calculations made to determine the solar parallax from the daguerrotypes taken by the French Commission during the transit of Venus in 1874, by M. Obrecht. The calculations have been carefully checked, and the definite result is represented by

$$\pi = 8''{\cdot}81 - 0''{\cdot}004\, dL \pm 0''{\cdot}06,$$

where π is the solar parallax, and dL the correction to be made for the longitude of Pekin.—Elements and ephemerides of the planet 246, deduced from the observations made on March 9 at Marseilles, Vienna, and Düsseldorf, on March 18 at Marseilles and Vienna, on March 31 at Berlin, and on April 9 at Marseilles, by M. Andoyer.—On a general law in the theory of the partition of numbers, by MM. Bougaieff.—A short and simple demonstration of M. de Sperre's theorem regarding Poinsot's "herpolhodie" curve, by M. A. de Saint-Germain.—Note on a method of regulating the velocity of electric motors, by M. M. Deprez.—*Régime* of combustion of explosive mixtures formed with illuminating gas, by M. A. Witz.—Description of the solar corona, the so-called "Bishop's ring," observed subsequently to the Krakatoa eruption in 1883, 1884, and 1885, by M F. A. Forel.—Researches on the phosphates: a method of reproducing at pleasure a large number of crystallised phosphates and oxides, by M. H. Debray.—On the oxidation of iodine during the process of natural nitrification, by M. A. Müntz. The object of this paper is to determine the natural conditions under which were produced the extensive deposits of nitrates in certain tropical regions.—On the ammoniacal sulphate of copper, and on a basic sulphate of copper, by M. G. André.—On the dimorphism of telluric anhydride and on some of its combinations, by MM. D. Klein and J. Morel.—On the chemical constitution of cocaïne, by MM. G. Calmels and E. Gossin.—Studies on the inhalation of bichloruretted formene (chloride of methylene) and of tetrachloruretted formene (perchloride of carbon), by MM. J. Regnauld and Villejean.—On the effects produced on man and animals by the stomachic ingestion and hypodermic injection of the microbes associated with the diarrhœic liquid of

cholera, and cultivated in peptonised gelatine, by M. Bochefontaine. Experiments made by the author on himself and on the guinea-pig tend to show that these preparations, when swallowed or injected in small doses, produce no morbid symptom, although large doses may give rise to more or less serious local inflammation. He infers that the physiological disorders observed in cholera patients are due, not to the development of the microbe germs, but to the presence of a special substance not yet determined; further, that in its normal state the blood of man and other animals is destructive to the choleraic microbes artificially prepared in gelatine.

BERLIN

Physiological Society, March 27.—Prof. Ewald spoke on the occurrence of lactic acid in human gastric juices, which was now universally regarded as a pathological formation, *i.e.* a product of fermenting processes which did not obtain under normal conditions. In conformity with this opinion he had, in a former investigation, clearly demonstrated the absence of lactic acid, even after milk had been partaken. On the other hand, he had regularly found hydrochloric acid in the gastric juice. Two cases of hysteric vomiting, which had come under his observation in the infirmary, induced him to resume this investigation, one of the cases especially inviting such inquiry. The female patient was able to retain on her stomach and normally digest solid food, but whenever she swallowed anything fluid the whole contents of the stomach were at once vomited. Opportunity was, therefore, here offered at any time to examine the contents of the stomach after food had been received. Prof. Ewald mentioned the different chemical reactions by means of which the presence of lactic acid might be easily detected in the gastric juice, and among them he deemed carbolic acid and chloride of iron the most trustworthy. He then described the experiments he had carried out on the female patient above referred to, which had yielded the following results:—After a mixed meal (of bread, vegetables, and meat), lactic acid was found 26 times out of 31 in the contents of the stomach in the space of 10 to 100 minutes after the reception of the food; in 5 cases, however, not till 120 minutes or more after that point of time. Hydrochloric acid was found in the contents of the stomach only in the second hour and later, after the lactic acid had disappeared. Out of 26 cases in which white bread was alone eaten, lactic acid was demonstrated in 17 cases, occurring in 10 to 100 minutes from the time of eating. Out of 15 cases in which cooked albumen was administered, lactic acid was found only in one case, within one-and-a-half hours from the time of its being taken; while, on "schabefleisch" (scraped raw meat) being administered, lactic acid became again demonstrable; in the majority of cases in 10 to 100 minutes' time. From these experiments it was to be inferred that lactic acid occurred normally in the contents of the stomach, namely, in the first period of digestion. It was, however, in the opinion of Prof. Ewald, no normal constituent of the gastric juice, but in the case of a mixed and meat diet originated in the carno-lactic acid obtained from the meat and, in the case of white bread being taken, from the fermentation of the starch. On albumen being taken, lactic acid was, therefore, not found, because it occurred in the stomach only when it was introduced with the food—in the case of meat, for example—or when it arose from a fermentive aliment. With reference to the ulterior issues of the lactic acid, the speaker adopted the view of Prof. Maly, that it was employed towards the formation of the free hydrochloric acid afterwards appearing in the gastric juice.—Dr. Blaschko reported some observations he had made on sensations of pressure. In the course of investigations into the development of the skin, he had found that the hair-roots were provided with a rich nerve plexus in the same manner as the touch corpuscles in the touch balls of the hands and feet, and this induced him to examine the hairs in respect of their sensibility to pressure. When he took a stiff hair a little curved at the tip, and stroked the skin with it, he had only then a sensation when he touched a lanugo hair. By this and other means he became convinced that the hair papillæ possessed such a high degree of sensibility as entitled them to be placed in a series with the touch papillæ. While, however, the touch corpuscles had to be drawn hither and thither over the object to be touched, in the case of the touch hairs the body to be felt had, on the contrary, to be waved over it. Dr. Blaschko was therefore of opinion that a direct and an indirect, or a papillary and a ciliary feeling of the skin had to be distinguished. The first performed its functions at the unhaired cutaneous spots; the touch balls of the hand, and the foot, and at the lips; by means of the touch corpuscles. The indirect or ciliary sensations, on the other hand, were performed by the lanugo hairs covering the whole body, which were properly, therefore, touch hairs. If at a limited spot of the skin, such as the forehead, the lanugo hairs were shaved away, then would the fine sensations of pressure likewise disappear, and on waving that part of the skin with the stiff hair above referred to, a correspondingly large hiatus would become perceptible, at which nothing would be felt. In the course of this investigation the speaker had failed to convince himself of the existence of special points of pressure, and controverted the doctrine set up by Dr. Goldscheider in the former sitting of the Society respecting the specific energies of the nerves of feeling, and their punctiform distribution over the surface. In the discussion which followed, Dr. Goldscheider maintained the accuracy of his former statements, and invited Dr. Blaschko to convince himself of their correctness according to the method prosecuted by him.

VIENNA

Imperial Academy of Sciences, February 5.—Contributions to general nerve and muscle physiology (seventeenth communication): on the electric stimulation of the sphincter of Anodonta, by W. Biedermann.—Experiments on the oxidation of albumen by potassium permanganate, by R. Maly.—On *Clemmys sarmatica*, nov. spec., from the Hernalstegel, near Vienna, by C. A. Purschke.—Remarks on the velocity of light in quartz, by K. Exner.—Histological and embryological researches on the uro-genital apparatus, by T. Tanosik.—On a new vegetable parasite of the human body, by R. von Wettstein.

February 12.—On the bloodless-vessels in the tail of Batrachian larvæ, by S. Mayer.—On the constitution of isutivinic acid, by T. Schreder.—On the isogyric plane of double-refracting crystals, by H. Pitsch.—On the geographical distribution of the Jurassic formation, by M. Neumeyr.

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